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RESEARCH ARTICLE

QUALITY ASSURANCE OF FISH FINGER WITH SPECIAL EMPHASIS ON ITS MICROBIAL EFFECT

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The present studies have deals with the status of some of the common food borne bacteria found during the processing and storage of the fish byproducts during subsequent period and the impact of freezing on extending the shelf life of the product. The fishfinger is the major value added product has been selected for assessing the quality with special emphasis on its microbiological analysis. The safety of foods is principally assured by control at the source, product design and process control, and the application of good hygienic practices during production, processing (including labeling), handling, distribution, storage, sale, preparation and use, in conjunction with the application of the HACCP system. This preventive approach offers more control than microbiological testing because the effectiveness of microbiological examination to assess the safety of foods is limited. The result of microbial analysis (Total Plate Count (TPC) and count of *Staphylococcus, Escherichia, Salmonella and Vibrio*) does not show any harmful indication of fishfinger during their processing and cold storage. The statistical analysis from the obtained data also revealed the significant correlation at 0.05% level.

Key words: Food borne bacteria, Fishfinger, Hygienic practice, TPC, Coliform

INTRODUCTION

Value addition can be considered as any activity that may change the nature of the raw material such that it will help to realize a better price at the point of sale. Value addition also should make the fish more convenient and also more appealing and attractive (Venugopal et al., 1995). Food and feed are distributed over far greater distances than before; therefore foodborne disease outbreaks can also be widespread. Foodborne illness caused by microorganisms is a large and growing public health problem. The emergence of increased antimicrobial resistance in bacteria causing disease is aggravating this picture (Tenover, 2006). Most countries with systems for reporting cases of foodborne illness have documented significant increases over the past few decades in the incidence of diseases caused by microorganisms in food, including pathogens like *Salmonella* sp, *Vibrio cholerae* and enterohaemorrhagic *Escherichia coli*, and *Staphylococcus aureus* (Novotny et al., 2004). The position of India as a major supplier of fish to the world market stands to get diluted unless conscientious efforts are made to re-orient the domestic seafood industry to process & supply what is demanded in the value added convenience forms.

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Value addition is the most talked about work in food processing Industry, particularly in export oriented fish processing industry because of the increased realization of valuable foreign exchange. Value can be added to fish and fishery products according to the requirement of different markets. These products range from the live fish and shell fish to ready to serve convenience products.

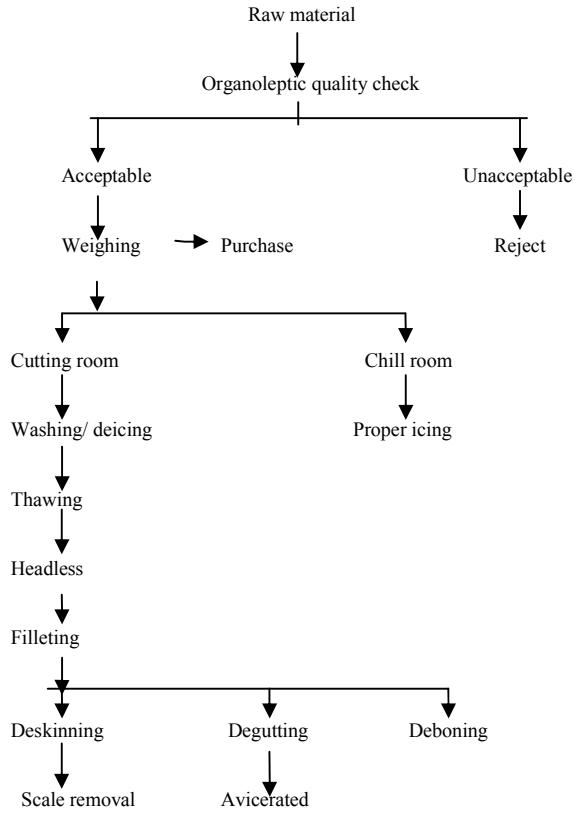
As per the fish processing Industry is concerned, "value addition is one of the possible approaches to raise profitability since this industry is becoming highly competitive and increasingly expensive. Traditional practice has been to depend on end product (Frozen fish and fishery products) inspection based on random sampling. Under this system, there was hardly any scope for traceability and corrective action to eliminate health hazards and economic losses. Foodborne disease takes a major roll on health (Newell et al., 2010). Thousands of people fall ill and many die as a result of eating unsafe food. Foodborne disease has implications both on health and development. Numerous outbreaks of foodborne disease have attracted media attention and raised consumer concern. However, the major problems are hidden among huge amounts of sporadic cases and smaller outbreaks. Most countries do not have good reporting systems, and a realistic estimation of the true burden of disease is difficult. Production of fish fingers was achieved by using fish species such as sardine (Sardina

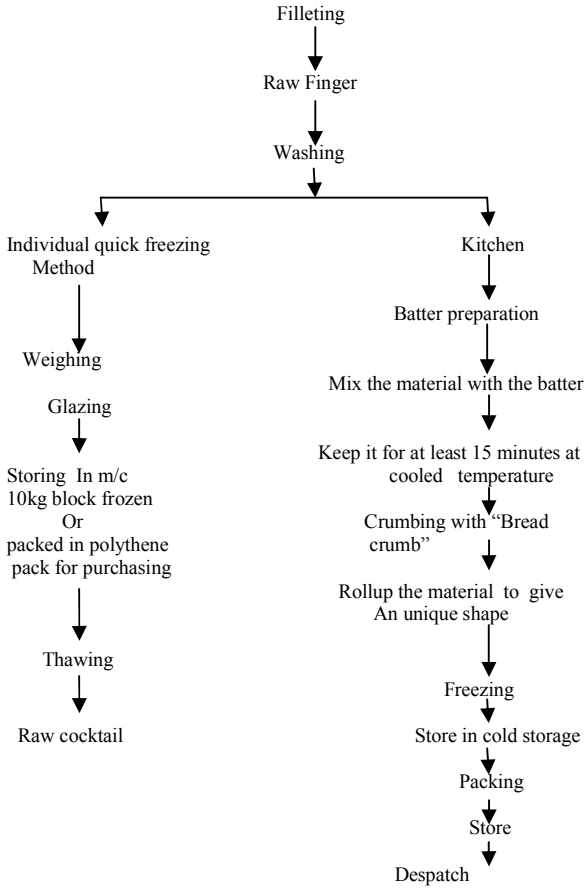
pilchardus, Walbaum, 1792), whiting (Merlangius merlangus, Linnaeus, 1758) and pike perch (Sander lucioperca, Linnaeus, 1758).

MATERIALS AND METHODS

The experimental work was carried out at IFB Agro Industries Ltd. Plot No. 5, Sector – I, East Kolkata Township, Kolkata 700107.

Flowchart of the detail study





Filleting Procedure

It is usually the first and principal operation in preparing fish for the consumer. Filleting is either done by hand or by machine and in some factories both methods are used. Whole frozen fishes are thawed before they are filleted and fish, wholly or partly thawed as required, are boned and iced and placed in a chilled room to await filleting. The temperature of some of the fish after thawing may be as high as 18 degree celsius and if they are not handled for some hours, there can be a considerable loss of quality if not iced. A cut is made down to the back bone from just behind the head to the tail. Then a cut is made just in the back of the gills down to the back bone. The knife is then turned flat and the cut extended to the tail by running the edge of the knife along the back bone and the ribs at the same time. The operation is repeated from the other side.

Skinning

Fillets from fish that have a relatively thick dark colour, bitter skin, & firm flesh are usually skinned before use. In this species, which have relatively soft flesh, leaving the skin on helps to hold the meat together during cooking, avoid rigor sharp knife as this will cut through the skin rather than follow the plane of the skin.

Steaking

Big fishes are commonly used, since large fish has larger backbones, two knives are required for steaking. Use a fillet knife for cutting the flesh & a much heavier knife or clever to cut through the backbones. The tail portion, where the fish is too narrow for proper sticking should be filleted. Leave the skin on sticks to hold the flesh together during cooking.

Bringing

The fillets/ sticks are dipped in brine (15% brine for 30 sec.) so as to enhance their appearance & to reduces the amount of drip. The brine coagulates proteinacious substances on the surface of the fillets and produces a prospective elastic film which controls the drip formation in the fillets. Bringing also provides salty flavour to the fish fillets.

Glazing

The fillets are usually glazed so as to form a protective film of ice covering the surface area. A sufficiently thick glaze prevents the evaporation of water from the frozen products and also controls the oxidation of fat. If required, permissible antioxidants & other additives could be incorporated in the glaze water to improve the quality of the end product. The weight of the glaze on a block of fillet may be from 2-7.1kg of the weight.

Freezing:

Fillet can be frozen by either individual quick freezing (IQF) or by block freezing.

Preparation of fish finger

Flow chart: (Directly from raw material or after thawing of the frozen material)

↓

Selection of the raw material
(Short out the remeat, broken and oddsmel materials)

↓

Batter preparation
(Corn flower, dion mustard, egg, salt, lemon, black pepper).

↓

Mix the material with the butter

↓

Keep it for at least 15 minutes in cold temperature

↓

Crumbing with "Bread crumb"

↓

Rollup the material to give a unique shape

↓

Finished fish finger

↓

Freezing(Individual quick freezing

↓

Store in cold storage temp: - 18 ^{o}C

↓

Packing

↓

Despatch

Storage and cooking of frozen fish

It is essential to adhere to the guidelines supplied on the packaging. Frozen foods purchased from reputed companies provide user friendly guides regarding storing their products. Best before dates should also be respected to ensure optimum quality. The guide will tell you how many months the fish can safely be stored for in a domestic freezer which is running correctly. Different varieties of fish and seafood have different storage time. Many varieties can be safely stored at below 18 degrees centigrade for up to ten months, enabling flexible consumption throughout the year.

METHOD OF MICROBIOLOGICAL ANALYSIS

Enumeration of Total Plate Count (TPC) is designed to provide an estimate of the total number of both aerobic & anaerobic microorganisms in a particular food. It reflects that the microbiological quality of the food and is useful for indicating the potential spoilage of the perishable food products. It is also an indicator of the sanitary condition under which the food was produced and / or processed and also of the level of Good Manufacturing Practices (GMP) adopted during processing.

The TPC of fish and fishery products generally do not relate to food safety hazards, but sometimes can be useful to indicate quality, shelf life and post heat processing contamination. The plating medium used in a TPC can affect the number and types of bacteria isolated because of differences in nutrient and salt requirements of the various microorganisms (Maturin and Peeler, 1998).

Determination of *E. coli* :

E. coli population was determined by culturing the organism in TGBE (Tryptone Glucose Beef Extract) agar, a selective medium (Kim and Feng, 2001).

Determination of *Staphylococcus aureus:*

S. aureus population was determined by culturing the organism in Baired parker medium, a selective medium (Capita et al., 2001)

Determination of *Vibrio cholerae :*

V. cholerae population was determined by culturing the organism in TCBS agar (Thiosulphate-Citrate-Salt-sucrose-agar), a selective medium (Lotz et al., 1983).

RESULTS AND DISCUSSION

From this investigation the random sample taken from different stages during preparation of the value added product showed that there was an inverse relationship between the freezing time and microbial load. During freezing period the microbes present in the food lost their spoilage activity and were destroyed to a large extent. Hence, by using the freezing method the spoilage of the fish can be retarded to a great extent (Al-Bulushi et al., 2005).

It was found that value added products widely spread in India, namely Fish finger (semi finished product) manufactured by IFB AGRO INDUSTRIES LIMITED, were safe for human consumption because both the raw material, frozen material and semi finished product (< 5×100000) were well within the acceptable level (Table 1). However, semi finished product showed the bacterial load higher than finished product and here the product fish finger was not flash fried so there was a chance of higher bacterial count than finished product, but the result was within the optimum limit. And from the experiment it was also found that there was absence of harmful pathogens causing food poisoning or food borne disease (Table 1). It was only possible when the whole process was done hygienically and critical control points of the product were monitored and maintained to the optimum level. The statistical analysis of experimental data is tabulated in the table -4 and reveals significant correlation at 0.05% level.

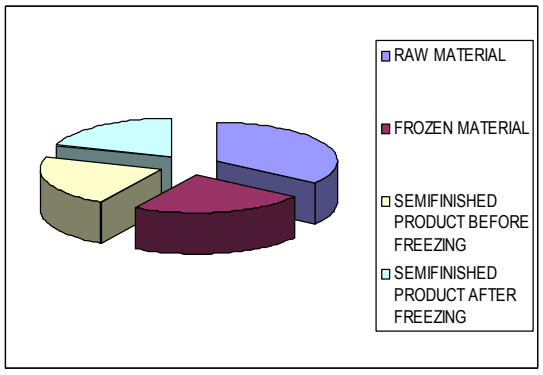


Fig. 1: Microbial load at different stages

Table 1. Bacterial load in fishfinger.

	Raw Material						Frozen Material						Semi- finished product before freezing						Semi- finished product after freezing					
DATE	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*	Date	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*	Date	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*	Date	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*
01.04.09	2,06 000	nil	nil	ND	ND	04.04.09	1,40 000	nil	nil	ND	ND	07.04.09	1,30 000	nil	nil	ND	ND	09.04.09	1,18 000	NP	NP	NP	NP
10.04.09	2,12 000	II	II	II	II	-	-	-	-	-	-	-	-	-	-	-	-	15.04.09	1,35 000	II	II	II	II
10.04.09	2,12 000	II	II	II	II	13.04.09	1,25 000	II	II	II	II	15.04.09	1,18 000	II	II	II	II	18.04.09	1,12 000	II	II	II	II
19.04.09	1,18 000	II	II	II	II	-	-	-	-	-	-	-	-	-	-	-	-	23.04.09	1.05 000	nil	nil	ND	ND
19.04.09	1,18 000	II	II	II	II	22.04.09	1,34 000	II	II	II	II	25.04.09	1,20 000	II	II	II	II	-	-	-	-	-	-
28.04.09	2,20 000	II	II	II	II	-	-	-	-	-	-	28.04.09	2,12 000	II	II	II	II	-	-	-	-	-	-
28.04.09	2,20 000	II	II	II	II	01.05.09	1,29 000	II	II	II	II	-	-	-	-	-	-	04.05.09	1,11 000	nil	nil	ND	ND

** ND = Not Detected : NP = Not Performed

Table 2. Bacterial load in frozen fishfinger

Raw Material						Frozen fishfinger					
Date	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*	Date	TPC CFU/g	*S aureus*	*E coli*	*V cholerae*	*Salmonella*
02.04.09	2,48,000	nil	nil	ND	ND	05.04.09	1,34,000	NP	NP	NP	NP
20.04.09	2,98,000	nil	nil	ND	ND	23.04.09	1,23,000	nil	nil	ND	ND
05.05.09	2,24,000	nil	nil	ND	ND	09.05.09	1,06,000	nil	nil	ND	ND

** ND = Not Detected : NP = Not Performed

Table 3. Organoleptic & Bacteriological Standard for Finished Products;

FACTORS	MAXIMUM TOLERANCE LIMIT
Net Weight	As per Buyers Specification
Thawed Count/Lb. or Kg	As per Buyers Specification
Dehydration	20%- For Shrimp. 10%- For Fishes. 5% - For Cephalopods
Discoloration of Shell/Meat	10%- For Shrimps. 5% - For all other Products
Deterioration	Nil
Black Spot on Shell/Meat	10%- For Headless Products Nil- For PUD/PD Products
Broken/Damaged Pieces	10% (Less than 4 segments consider as Broken Pieces packed as PUD Broken grade)
Legs,Veins,Antenna,Soft Meat,Hanging Meat	10%, Soft shell are peeled and packed as PUD or PD.
Objectional Foreign Matter	Nil.
Uniformity	1:2 ratio,
Texture	Slight toughness for Headless Products. Moderate toughness for PUD/PD. Soft or Firm for other Fishes.
Total Plate Count	5,00,00/gm at 37°c.
Staphylococcus	100/gm
E. coli	20/gm at 44°c.
Salmonella	Nil.
Vibrio cholerae	Nil.
Vibrio parahaemolyticus	Nil.

Table 4. Bivariate Correlations of Bacterial Load in fishfinger

		VAR00001	VAR00002	VAR00003	VAR00004
VAR00001	Pearson Correlation	1.000	.087	-.488	-.762
	Sig. (2-tailed)	.	.838	.220	.010
	N	14	8	8	10
VAR00002	Pearson Correlation	.087	1.000	.764	-.109
	Sig. (2-tailed)	.838	.	.046	.815
	N	8	8	7	7
VAR00003	Pearson Correlation	-.488	.764	1.000	.065
	Sig. (2-tailed)	.220	.046	.	.903
	N	8	7	8	6
VAR00004	Pearson Correlation	-.762	-.109	.065	1.000
	Sig. (2-tailed)	.010	.815	.903	.
	N	10	7	6	10

* Correlation is significant at the 0.05 level (2-tailed).

Generally, microbial loads decreased from capture to dispatch although they were unbelievably low at fishing grounds and exceptionally high at landing sites. The risk of fish contamination by pathogens as indicated by the presence of coliforms was highest at landing sites and within the processing plants. Due to high perishability property of fish & shell fish they are generally attacked by various microbes after death which are harbor in fishes and rapidly degrade the product by enzymatic spoilage.

Therefore, it is clear that the study on microbiological analysis on fish value added product, when compared to the other microbiological study conducted on other value adder products, the shows that value added product available in the Indian market produced by IFB AGRO INDUSTRIES is safe for human consumption and there poisoning and food borne diseases caused by the micro organisms.

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